Monoolein-based lipoplexes (DODAB/MO/DNA) as non-viral vector for transfection- from physicochemical characterization to biological application

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Cationic liposomes/DNA (lipoplexes) have been widely used as non-viral vectors for transfection, the role of the neutral lipid in liposome formulation being determinant for the efficiency of this process [1,2]. In this work, we studied the potential of monoolein (MO) as *helper* lipid for cellular transfection. Lipoplexes composed of pDNA and dioctadecyldimethylammonium bromide (DODAB)/1-monooleoyl-rac-glycerol (MO) at different molar ratios (4:1, 2:1 and 1:1) were investigated, as well as different cationic lipid/DNA ratios. The physicochemical properties of the lipoplexes (size and charge), the formation of the lipoplexes, the effect of MO on pDNA condensation and the effect of heparin on percentage of pDNA release from the lipoplexes were also studied by Ethidium Bromide (EtBr) exclusion assays, Dynamic Light Scattering (DLS), Zeta Potential (ζ) and electrophoresis. The cytotoxicity, transfection efficiency, as well as the intracellular localization of labeled DNA were evaluated on 293T cells. It was found that the presence of MO not only increases the efficiency of pDNA compactation, but also affects the physicochemical properties of lipoplexes, which could possibly interfere with lipoplex-cell interactions. The DODAB:MO (2:1) and (4:1) formulations were capable of efficiently mediate *in vitro* cell transfection. These results were consistent with fluorescence microscopy studies, which illustrated that lipoplexes were able to gain entry into the cytosol and deliver pDNA to the nucleus. Understanding the structure–activity relationship of MO based lipoplexes will give direction toward the development of safe and efficient gene delivery systems.

1.Felgner, P.L., et al., Lipofection Procedure - A Highly, Efficient, Lipid-mediated DNA-transfection Procedure. Proceedings of the National Academy of Sciences U.S.A., 1987. 84: p. 7413-7417.

2.Real-Oliveira, M.E.C.D., et al, Patente Nacional n. PT 104158, I.N.d.P. Industrial, Editor. 2008. p. 1-28.

3. Real-Oliveira, M.E.C.D., et al., International Patent in Submission, W.I.P. Organization, Editor. 2009. p. 1-27.

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